

polishing the device to remove a part of the wiring metal residing higher than an upper peripheral level of the first concavity to leave a first metal layer in the first concavity;

applying a solution of a compound onto the surface of the device so as to form a protective film for preventing metal diffusion on a surface of the first metal layer;

wherein the compound is stannous chloride, stannous borofluoride, stannous sulfate, nickel sulfate, nickel chloride, or nickel sulfamate;

forming on the device a second insulating film contacting the first insulating film and the protective film;

making a second concavity simultaneously in the second insulating film and the protective film in a region above the first metal layer;

covering the second concavity with a second barrier layer; and

burying the second concavity covered with the second barrier layer with a second wiring metal layer, the second wiring metal layer contacting the first metal layer.

REMARKS

In the last Office Action, the Examiner required a proposed drawing change or corrected drawings to indicate that Figs. 9A-9D show prior art. Accordingly, Applicants submit herewith a Request for Approval of Drawing Change to add the term --Prior Art-- to Figs. 9A-9D. Applicants respectfully request that this drawing change be approved, and that the objection be withdrawn.

The Examiner rejected claims 11, 13, 15, and 16 under 35 U.S.C. § 103(a) as being unpatentable over Obeng et al. (U.S. Patent No. 6,323,131) ("Obeng") in view of Asai et al. (U.S. Patent No. 5,736,770) ("Asai"), rejected claim 12 under 35 U.S.C.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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§ 103(a) as being unpatentable over Obeng and Asai, and further in view of Avanzino et al. (U.S. Patent No. 6,350,687) ("Avanzino"), and rejected claims 14, 20, and 21 under 35 U.S.C. § 103(a) as being unpatentable over Obeng, Asai, and Avanzino, and further in view of Endo et al. (U.S. Patent No. 5,795,828) ("Endo").

By this Amendment, Applicants have proposed changes to Figures 9A-9D as suggested by the Examiner and amended claims 11 and 14. Claims 11-16 and 20-21 are pending in this application.

With regard to the rejections of claims 11-16 and 20-21, Applicants respectfully submit that the Examiner's assertions as to certain combinations of the cited prior art do not establish a proper *prima facie* case of obviousness under 35 U.S.C. § 103(a). It appears that the Examiner has improperly pieced various aspects of the present method invention from the prior art together with a good deal of hindsight and with the invention as a road map to make an obviousness rejection.

Applicants respectfully urge that such allegations do not establish a proper *prima facie* case of obviousness under 35 U.S.C. § 103(a). "The examiner bears the initial burden, on review of the prior art on any other ground, of presenting a *prima facie* case of unpatentability." In re Oetiker, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992) (Emphasis original). To establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art references, when combined, must teach or suggest all of the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Finally, there must be a reasonable expectation of success. M.P.E.P. § 2143.

Furthermore, the teaching or suggestion to make the claimed combination must be found in the prior art, not in Applicants' disclosure. In Re Vaeck, 947 F.2d 488, 493, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991). Additionally, the evidence of a teaching, suggestion, or motivation to combine must be "clear and particular." In Re Dembiczak, 175 F.3d 994, 999 (Fed. Cir. 1999). As will be described below, combining the cited references is improper for the following reasons.

The Examiner has failed to meet the first criteria for establishing a *prima facie* case of obviousness. Specifically, the cited references, either taken individually or in combination, fail to disclose or suggest all of the claim elements. Thus, the cited combination of references fail to render obvious the subject matter of claims 11 and 14.

For example, independent claims 11 and 14 are each directed to a method of manufacturing a semiconductor device, including, among other things, "making a second concavity simultaneously in the second insulating film and the protective film in a region above the first metal layer." Support for this claimed step can be found at least on page 3, lines 14-17 and page 6, lines 24-30 of the specification. The cited references do not disclose or suggest the claimed invention, including these elements. More specifically, the primary reference, Obeng, does not disclose any plasma/wet etching including making "a second concavity simultaneously in the second insulating film and the protective film." (Col. 2, lines 51-61). On the contrary, Obeng discloses that when the trenches 16 are etched in the dielectric layer 10, which the Examiner asserts is the second-insulating film, it is preferred that the etching be done without damaging any self-assembled organic sealant film, which the Examiner asserts is the protective film. (Col. 4; lines 15-19). Accordingly, because the Examiner has failed to

meet the burden of providing a prima facie case of obviousness, Applicants respectfully request the allowance of independent claims 11 and 14 and their respective dependent claims.

Additionally, the Examiner has failed meet the second criteria for establishing a cause *prima facie* obviousness. Specifically, the Examiner has failed to show that there is any suggestion or motivation to combine the Obeng and Asai references as suggested by the Examiner. In rejecting claims 11-16 and 20-21, the Examiner asserted (on page 3 and 5 of the Office Action) that it would have been obvious to form an alleged second insulating film as taught by Asai in the process of Obeng because "this would provide protection of the underlying conductive layer and improve planarity of the device." First of all, Asai and Obeng do not disclose any protective role played by their alleged second insulating films in relation to their respective conductive layers, as required by In Re Vaeck. Thus, because this alleged teaching or suggestion to make the claimed combination is not found in the prior art, the references may not properly be combined. Second, Applicants fail to see (and the references do not teach) how implementing the interlaminar insulating film 6 of Asai in the process of Obeng would improve planarity, since Obeng discloses a plethora of surfaces that are already planar, and implementing Asai would destroy the planarity of several surfaces in Obeng. For example, implementing the interlaminar insulating film 6 would require that the oxidation-resistant film 11 of Asai only cover portions of the copper layer/dielectric layer surface in Obeng, resulting in a nonplanar surface. Finally, because the self-assembling organic film in Obeng serves several purposes on surfaces other than the copper layer, there is no motivation to limit the film to the silicon layer surface as

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

disclosed in Asai so as to allow the interlaminar insulating film 6 to contact both the silicon nitride film 11 and silicon oxide film 13. For example, the self-assembling organic film serves to seal the silicon edge and backside (col. 4, lines 13-15), and "[a]ny such film 14 which is on top of the dielectric 10 will act as a photoresist adhesion promoter." (Col. 4, lines 19-20). To modify Obeng in view of Asai as suggested by the Examiner would be contrary to these purposes. Accordingly, because the Examiner has failed to show why one of ordinary skill in the art would be motivated to combine Asai and Obeng, Applicants assert the Examiner has not met the burden of establishing a *prima facie* case of obviousness, and thus respectfully request withdrawal of these rejections.

Applicants respectfully request that this Amendment under 37 C.F.R. § 1.116 be entered by the Examiner, placing claims 11-16 and 20-21 in condition for allowance. Applicants submit that the proposed amendments of claims 11-16 and 20-21 do not raise new issues or necessitate the undertaking of any additional search of the art by the Examiner, since all of the elements and their relationships claimed were either earlier claimed or inherent in the claims as examined. Therefore, this Amendment should allow for immediate action by the Examiner.

Furthermore, Applicants respectfully point out that the final action by the Examiner presented some new arguments as to the application of the art against Applicant's invention. It is respectfully submitted that the entering of the Amendment would allow the Applicants to reply to the final rejections and place the application in condition for allowance.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

Finally, Applicants submit that the entry of the amendment would place the application in better form for appeal, should the Examiner dispute the patentability of the pending claims.

In view of the foregoing remarks, Applicants submit that the claimed invention is neither anticipated nor rendered obvious in view of the prior art references cited against this application. Applicants therefore request the entry of this Amendment, the Examiner's reconsideration and reexamination of the application, and the timely allowance of the pending claims.

The Office Action contains characterizations of the claims and the related art with which Applicants do not necessarily agree. Unless expressly noted otherwise, Applicants decline to subscribe to any statement or characterization in the Office Action.

In discussing the specification, claims, abstract, and drawings in this Amendment After Final, it is to be understood that Applicants are in no way intending to limit the scope of the claims to any exemplary embodiments described in the specification or abstract and/or shown in the drawings. Rather, Applicants believe that Applicants are entitled to have the claims interpreted broadly, to the maximum extent permitted by statute, regulation, and applicable case law.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

Please grant any extensions of time required to enter this response and charge
any additional required fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: June 24, 2003

By: 

Michael W. Kim
Reg. No. 51,880

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

APPENDIX TO AMENDMENT OF JUNE 24, 2003
VERSION WITH MARKINGS TO SHOW CHANGES MADE

AMENDMENTS TO THE CLAIMS

11. (Twice Amended) A method of manufacturing a semiconductor device, comprising the steps of:

making a first concavity in a first insulating film of the device;

covering the first concavity with a first barrier layer for preventing metal diffusion;

burying the first concavity covered with the first barrier layer with a wiring metal;

polishing the device to remove a part of the wiring metal residing higher than the upper peripheral level of the first concavity so as to leave a first metal layer in the first concavity;

applying a solution of an organic substance to the device so as to form a protective film of the organic substance on a surface of the first metal layer for preventing metal diffusion;

forming on the surface of the device a second insulating film contacting the first insulating film and the protective film;

making a second concavity simultaneously in the second insulating film and the protective film in a region above the first metal layer;

covering the second concavity with a second barrier layer; and

burying the second concavity covered with the second barrier layer with a second wiring metal layer, the second wiring metal layer contacting the first metal layer.

14. (Twice Amended) A method of manufacturing a semiconductor device, comprising the steps of:

making a first concavity in a first insulating film of the device;

covering the first concavity with a first barrier layer for preventing metal diffusion;

burying the first concavity covered with the first barrier layer with a wiring metal;

polishing the device to remove a part of the wiring metal residing higher than an upper peripheral level of the first concavity to leave a first metal layer in the first concavity;

applying a solution of a compound onto the surface of the device so as to form a protective film for preventing metal diffusion on a surface of the first metal layer;

wherein the compound is stannous chloride, stannous borofluoride, stannous sulfate, nickel sulfate, nickel chloride, or nickel sulfamate;

forming on the device a second insulating film contacting the first insulating film and the protective film;

making a second concavity simultaneously in the second insulating film and the protective film in a region above the first metal layer;

covering the second concavity with a second barrier layer; and

burying the second concavity covered with the second barrier layer with a second wiring metal layer; the second wiring metal layer contacting the first metal layer.

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com